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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/817,056	03/27/2001	Kai Yang	50432-067	9188

7590 03/24/2003  
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600 13th Street, N.W.  
Washington, DC 20005-3096

EXAMINER

NGUYEN, THANH T

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 03/24/2003

12

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	09/817,056	YANG ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 January 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☐ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 13-20 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6-12 is/are allowed.
- 6) ☐ Claim(s) 1-5 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \*   c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                          | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>11</u> . | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Response to Arguments*

Applicant's arguments filed 1/2/03 have been fully considered but they are not persuasive.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

- (e) the invention was described in-
  - (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
  - (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1-2 and 4-5, 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Chooi et al. (U.S. Patent No. 6,284,657).

Referring to figures 1, 4-8, Chooi et al. teaches a method of manufacturing a semiconductor device:

Forming a first dielectric layer (18) overlying a substrate (10, see figure 1 and col. 5, lines 24-48),

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Forming a first barrier layer (20, a silicon nitride layer, SiN, called a “cap layer” in Chooi et al., meeting claim 2), comprising a first dielectric barrier material of silicon nitride (20) on the first dielectric layer (18) with an interface therebetween,

Etching to form a first opening (22) defined by side surfaces and a bottom of the first dielectric layer (18, see figure 4, note: figure 3 is a prior art) which is parallel (as claimed in claim 21),

Forming a second barrier layer (15, a silicon carbide layer, SiC, called a “non-metallic layer” in Chooi et al., see figures 5, col. 6, lines 21-33, meeting claim 2), comprising a second dielectric barrier material of SiC (15) different from the first dielectric barrier material of silicon nitride (20, SiN), on an upper surface of the first barrier layer (20) overlying the first dielectric layer (18), on the side surfaces of the first dielectric layer (18) defining the first opening and on the bottom of the opening (22),

Etching, with selectivity to the first barrier layer (20), to remove the second barrier layer (15) from, and stopping on, the upper surface of the first barrier layer (20), and to remove the second barrier layer (15) from the bottom of the first opening (22), leaving a portion of the second barrier layer (15) as a liner (19) on the side surfaces of the first dielectric layer (18) defining the first opening (22, see figure 6, col. 6, lines 34-49), and

Filling the opening with metal (copper, meeting claim 5) to form a lower metal feature (see col. 7, lines 5-7),

In regarding to claim 3, depositing second barrier layer of silicon carbide (15) by chemical vapor deposition (CVD, see col. 6, lines 23-33, meeting portion of claim 3),

In regarding to claim 4, depositing first barrier layer of silicon nitride (20, SiN) at a thickness of between 500-5,000 Å (see col. 5, lines 43-45) and second barrier layer of silicon carbide (15) at the thickness of between 50-5,000 Å (see col. 6, lines 23-33).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi et al. (U.S. Patent No. 6,284,657) as applied to claims 1-2, 4-5, and 21 above, and further in view of Chung et al. (U.S. Patent No. 6,017,817).

Chooi et al. teaches using silicon nitride layer as a cap layer (first barrier layer) and silicon carbide as a second barrier layer as shown in figures 1 and 4, but fails to teach that depositing a silicon nitride layer by a Chemical vapor deposition method (CVD, as claimed in claim 3). Nevertheless, such processing step is known in the semiconductor processing art as evidenced by Chung et al. Chung et al. teach a method of forming a silicon nitride (208) cap layer by using CVD process (see col. 3, lines 25-29 and figure 2A).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time the invention was made would depositing a silicon nitride layer as first barrier layer and

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silicon carbide as second barrier layer by a CVD method in Chooi et al.'s process as taught by Chung et al. *because* depositing a silicon nitride layer by CVD process would provide a film layer having good thickness uniformity, high purity and good step coverage.

### *Allowable Subject Matter*

Claims 6-12 are allowed over the prior art.

### *Response to Arguments*

Applicant's arguments filed 1/2/03 have been fully considered but they are not persuasive.

In regard to the newly amended claims, applicant contends that Chooi et al. does not teach single dielectric layer over the substrate. In response to applicant argument that Chooi et al teaches forming a single dielectric layer (18) over the substrate (10) and depositing a barrier layer (20) over the dielectric layer with an interface therebetween (see figures 1, 4-8).

### *Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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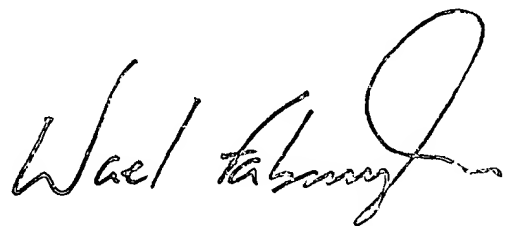
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (703) 308-9439. The examiner can normally be reached on Monday-Thursday from 6:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanh Nguyen

A handwritten signature in black ink, appearing to read 'Wael Tahany', is written over a horizontal line.

SUPERVISORY PRIMARY EXAMINER  
TECHNOLOGY CENTER 2600